Small Business Innovation Research/Small Business Tech Transfer

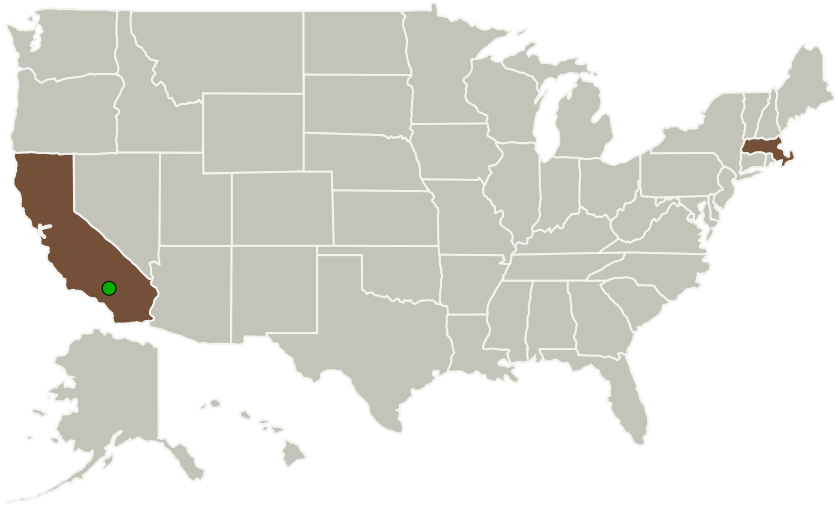
Active Twist Control for a Compliant Wing Structure, Phase I

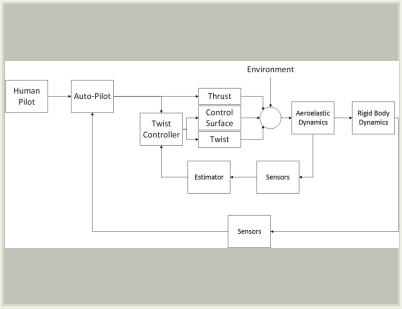
Completed Technology Project (2015 - 2016)

Project Introduction

Blended wing body (BWB) aircraft provide an aerodynamically superior solution over traditional tube-and-wing designs for a number of mission profiles. These platforms provide an all-lifting surface with a reduced wetted area, which lead to significant aerodynamic improvements over their conventional counterparts. However, due to their lack of a conventional tail surface with which to trim in pitch during low-speed operations, these aircraft suffer from a number of stability issues. Chief among these issues is the potentially catastrophic loss of feedback – normally a function of the tail surfaces – when the wing stalls at high angles of attack. This problem is further manifested through the large variation in stall behavior across the BWB's wingspan due to significant thickness differences between the payload-carrying centerbody and the aerodynamically efficient outer wing portions of the vehicle. Aurora Flight Sciences, in collaboration with Professor Mircea Teodorescu of the University of California at Santa Cruz, proposes an actively twisted compliant wing architecture for BWB aircraft that mitigates the stall concerns typically associated with these platforms while providing a significant increase in aerodynamic efficiency. The practical implication resulting from this novel approach is a state-of-the-art compliant wing architecture that provides active control of the twist along the span of the wing by sensing and appropriately responding to oncoming stall risks, thereby eliminating the need for outer wing washout and drastically improving the aerodynamic performance of the wing during cruise. These innovative concepts will be used to complete a preliminary design and build of the wing structure for proof-of-concept flight testing by the end of Phase I.

Primary U.S. Work Locations and Key Partners





Active Twist Control for a Compliant Wing Structure, Phase I

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

Active Twist Control for a Compliant Wing Structure, Phase I

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Organizations Performing Work	Role	Type	Location
Armstrong Flight Research Center(AFRC)	Supporting Organization	NASA Center	Edwards, California
University of California-Santa Cruz	Supporting Organization	Academia	Santa Cruz, California

Primary U.S. Work Locations	
California	Massachusetts

Project Transitions

June 2015: Project Start

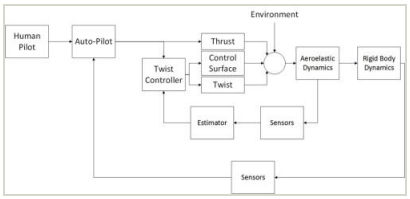
June 2016: Closed out

Closeout Summary: Active Twist Control for a Compliant Wing Structure, Phase I Project Image

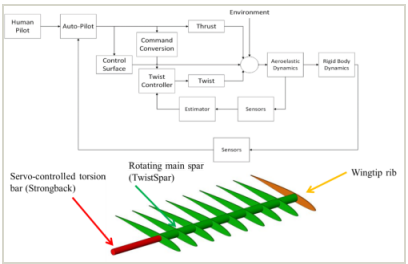
Closeout Documentation:

- Final Summary Chart Image*(https://techport.nasa.gov/file/138771)*

Images



Briefing Chart Image
Active Twist Control for a Compliant Wing Structure, Phase I *(https://techport.nasa.gov/image/135417)*



Final Summary Chart Image
Active Twist Control for a Compliant Wing Structure, Phase I Project Image *(https://techport.nasa.gov/image/132644)*

Project Management

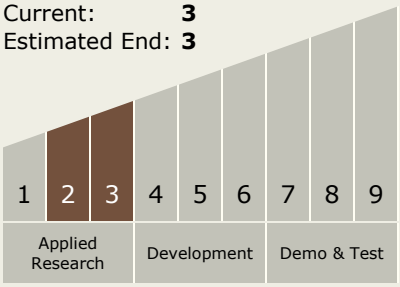
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Cory Kays

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.6 Fault Response

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System